

**DONALD P. HANSON, R.G.**

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OCT 15 2013

WYOMING OIL & GAS  
CONSERVATION COMMISSION

**Title**

Principal Hydrogeologist

**Expertise**

RI/FS, EE/CA, Remedial Technology Costing

**Academic  
Background**

B.S., Geology/Hydrogeology, Northern Arizona University, 1984

**Registration/  
Certification**

Registered Geologist, 1992 - Arizona Registration No. 26036  
Professional Geologist, 1998 - Wyoming Registration No. PG-2983  
American Institute of Professional Geologists, 2003 - MEM-0532

**Experience**

Don Hanson joined Clear Creek Associates in 2000. He has nearly 30 years of experience conducting remedial investigations, evaluating corrective actions, and performing remediation at CERCLA, WQARF, RCRA, and LUST sites. He currently serves as a technical expert on several groundwater remediation projects. He has managed a multi-disciplinary multi-million dollar state Superfund landfill investigation. He has also managed the design, implementation, and operation of soil and groundwater remediation systems, including soil stabilization, dig and haul, soil vapor extraction (SVE), bioventing, air-sparging (AS), pump and treat (P&T), ORC<sup>(TM)</sup>, air stripping, catalytic oxidation, precipitation/ultra-filtration, and carbon adsorption. Mr. Hanson deals extensively with state and local agencies and is well acquainted with RCRA, CERCLA, WQARF (Arizona Superfund) and other state programs including APP, SPCC, SWPPP, UST/LUST, SAF and ADEQ's voluntary remediation program (VRP).

Mr. Hanson has a wide range of technical capabilities having conducted field investigations in both the saturated and unsaturated zones. He has supervised numerous drilling operations, analyzed geologic and geophysical logs, designed numerous types of wells, and evaluated groundwater sampling and monitoring results, aquifer testing, and pilot testing of various remediation/treatment methods. He has managed complex environmental sites with numerous types of contaminants including metals, pesticides, halogenated and aromatic VOCs, SVOCs, fuels, PCBs, PAHs, and radiologicals. He has also evaluated natural and enhanced biodegradation methodologies for chlorinated solvents and fuels and has managed the assessment of risks to human health and the environment from various contaminants.

Prior to joining Clear Creek Associates, Mr. Hanson was manager of the Phoenix office of Harding Lawson Associates, a national engineering and environmental consulting firm.

**Representative projects include:**

- COP Aviation - Estes Landfill WQARF Site RI/FS/EECA/Manager
- TOG - Unichem WQARF Site Review/Cost Analysis/Technical Oversight
- Motorola, Inc. (52nd Street), Federal Superfund RI/FS/Support
- COP EAS - Former Southwest Cooperative Pesticide and Arsenic Conceptual FS/Remediation/Manager
- General Electric Plastics, State WQARF Site Groundwater RI/Support
- COP Aviation - Former Fire Fighter Training Pit VRP Closure/Manager
- Terminal Stations, Tucson, Arizona LUST SVE Remediation/Manager
- COP Aviation - AFFC Jet-A Bioventing Remediation/Technical Oversight
- COP Aviation - 161<sup>st</sup> ANG LUST SVE Remediation/Technical Oversight

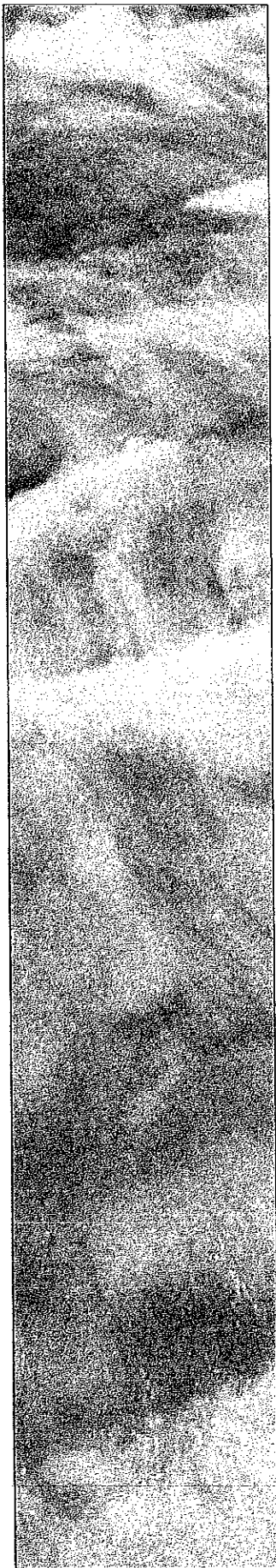
**DONALD P. HANSON, R.G.**

- COP Aviation – West Sky Harbor Biosparge Remediation/Technical Oversight
- FCX – Pinal Creek WQARF Groundwater Recharge for Remediation FS/Manager
- FCX – Iron King VRP Acid Mine Drainage Remediation/Support
- COP Aviation – Sky Harbor Terminal 4 Car Rental Facility UST Closure/Manager
- Land Developer – Lead Remediation/Closure/Manager
- COP EAS - 19th Avenue Landfill, Federal Superfund RI/FS/Support
- Motorola, Inc. (56th Street) Voluntary WQARF RI/FS/Support
- Univar – Arsenic Risk Assessment RCRA Closure/Support
- COT– Price Road Service Center LUST SVE Remediation/Support
- Chevron Products Company, El Paso Refinery RCRA Closure/Manager
- Unocal Corporation, Arizona LUST Investigations/Remediation/Manager
- Chevron U.S.A. Inc., Arizona LUST Investigations/Manager
- Arizona Public Service, Arizona AST and LUST Investigations/ Remediation/ Manager
- Chemical Handling Facility, Phoenix, Arizona RCRA Compliance/Support
- Arizona Public Service, Arizona PCB Cleanups/Manager
- Industrial Facility, Chandler, Arizona air emissions monitoring for RCRA compliance/Support
- Independent Bancorp of Arizona Due Diligence/Manager
- Arizona Public Service Company Due Diligence/Manager
- Kitchell Development Due Diligence/Manager
- Dry Cleaning Facility Soil Gas Investigation/Support
- Unregulated Pesticide Disposal Site/Support

**Project Details**

**Estes Landfill, State WQARF Site, Phoenix, Arizona** – Manager for an RI/FS to assess the magnitude and extent of air, soil and groundwater contamination in the vicinity of a closed unregulated landfill site which operated during the 1950's and 1960's. The site is technically complex; with VOC contamination present in a multiple aquifer/aquitarid hydrogeologic system. In addition, the site is adjacent to the ephemeral Salt River which is normally dry but has had intermittent flows upwards of 200,000 cubic feet per second. River flows alter the groundwater flow direction nearly 90 degrees and raise local water levels upwards of 60 feet in a matter of weeks. Chemicals of concern include PCE, TCE, cis- and trans-1,2-DCE and vinyl chloride. Another privately owned landfill is located immediately adjacent to the Estes Landfill, which furthered complicated the site characterization efforts.

RI activities included the preparation of project planning documents and work plans for review and approval by ADEQ. Investigative techniques included locating and installing both single and nested monitor wells, installing and testing groundwater extraction wells, geotechnical sampling and geologic coring, aquifer testing, groundwater flow modeling (MODFLOW), and source characterization activities via surface geophysics, soil gas surveys, and historical data reviews. The RI concluded that the primary source for VOCs in groundwater was a former liquid disposal pit located on the boundary between the two landfills.



**DONALD P. HANSON, R.G.**

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FS activities included the identification of suitable remedial technologies, screening, formulation of remedial alternatives, and development of cost analyses. To further evaluate performance of remedial technologies and to refine remediation costs, both laboratory (bench) scale and field pilot testing of several remedial technologies were conducted including groundwater treatment via UV-Peroxidation, Ozonation, Precipitation/Filtration, and Air Stripping. Other FS activities included air dispersion modeling of air stripper off-gas to determine whether vapor treatment would have to be added to this remedial alternative. Results from that modeling indicated that it would be required. Therefore, various off-gas treatment technologies were evaluated including incineration, catalytic oxidation, and regenerative absorptive media. A cost analysis for each of these technologies was completed and incorporated into the overall remedial alternative cost evaluation. Other remedial technologies that underwent FS screening and cost analysis included monitored natural attenuation, in situ bioremediation, air sparging, and enhanced groundwater extraction techniques.

As part of a separate Engineering Evaluation/Cost Analysis (EE/CA), remedial alternatives related to landfill capping were developed and analyzed. Three types of landfill caps were evaluated including a RCRA Subtitle C cap, a RCRA Subtitle D cap, and an armored cap. Elements of the cost analysis included grading and drainage components, permitting, cap material and construction costs, landfill gas recovery, and long-term maintenance.

Additional activities related to this project involved the preparation of project planning documents, permitting (NPDES and Poor Quality Groundwater Withdrawal), support for a State prepared Baseline Risk Assessment, and development of a Human Health Risk Assessment, preparation of ARARs, development of a Fact Sheet and support for other community involvement activities.

During the course of the RI/FS, the site was successfully been litigated under CERCLA. Much of the FS cost analyses were used to support cost recovery efforts. The site has state Superfund listing under WQARF and is currently a State lead project.

**Town of Gilbert, Former Unichem State WQARF Site, Gilbert, Arizona** - Project manager of a PCE Site evaluation and remedial costing. Unichem (aka Cooper and Commerce WQARF Site) purchased the Facility in 1977 from Nu Development Corporation, and constructed facilities for the production of copper sulfate from scrap metal. The copper sulfate production process used aqueous ammonia, blended with kerosene, and sulfuric acid to extract copper from the scrap metal. A diesel-fired boiler with heat exchangers was used to heat the process stream before the crystallization of copper sulphate. PCE was used as a refrigerant in the crystallization process. Unichem discontinued operations at the Facility prior to 1983. The Town of Gilbert owns and operated a reclaimed water recharge facility adjacent to the site. This facility was an integral component of the water reclamation facility as well as an important water resource component for the Town's overall Designation of Assured Water Supply.

After receiving a Notice of Violation followed by a Cease and Desist of recharge operations from ADEQ, the Town's outside counsel retained Clear Creek to review site conditions and develop cost estimates for the remediation of PCE in soil and groundwater. Review of the data indicated that elevated concentrations of PCE were present in soil (4,200 mg/kg) and groundwater (650 ug/l). The AWQS for PCE in groundwater is 5 ug/l. It was also determined that recharge operations were influencing groundwater concentrations and the movement of the PCE was towards an active Town of Gilbert public supply well.

## **DONALD P. HANSON, R.G.**

A remedial cost analysis was developed to remediate PCE impacted soils via soil vapor extraction and treatment. The purpose of the cost analysis was to allow the Town to determine whether it was more cost effective to remediate the site as a volunteer or to construct a new pipeline to re-route the reclaimed water to another nearby recharge facility. The cost analysis included design of the remediation system, permitting (air quality and construction), construction of the SVE wells and associated piping, a comparison of purchase vs. lease for the vapor treatment system, electrical, system O&M, groundwater and vapor monitoring, reporting, and site closure.

**Motorola, Inc. (52nd Street), Federal Superfund Site, Phoenix, Arizona** - Field supervisor and task manager of RI/FS well sampling for volatile organics, semi-volatiles, and inorganics from both conventional and multiport Westbay<sup>(TM)</sup> wells. Performed daily operation and maintenance of a groundwater pump and treat system for the removal of VOCs (primarily TCE), heavy metals, and fluoride. Groundwater was extracted from two source recovery wells. The contaminated groundwater was initially treated via air stripping with off-gas treatment followed by precipitation and ultrafiltration, and finally polishing by liquid GAC. The treated water was beneficially used to replace City water in onsite cooling towers.

Responsibilities included performing off-gas sampling, treatment system testing and cleaning, filter press operations, chemical ordering, onsite vapor phase carbon regeneration activities, and liquid GAC replacement. Tracked all costs associated with operation and maintenance, overall system and component performance, and compliance reporting.

**City of Phoenix Aviation – Former Southwest Cooperative Conceptual FS/Remediation VRP Project, Phoenix, Arizona** – Project manager for the characterization, development of remedial cost scenarios, and ultimate risk-based remediation of residual pesticides and arsenic soil contamination at this former pesticide formulation facility. The site had been previously issued an NFA by ADEQ, however, it was rescinded after a thorough site characterization conducted by Clear Creek revealed extensive residual contamination above clean up goals.

As a perspective purchaser of the site, the City required detailed and accurate remediation cost estimates to negotiate a fair and reasonable purchase price that had to be presented to and approved by the City Council. Detailed costs were prepared related to the development of the remedial action plan, community involvement, waste profiling, waste excavation and transportation to appropriate hazardous and non-hazardous disposal facilities, confirmation sampling, completion of Health Risk Assessment, preparation of the remediation closure report, new site Declaration of Environmental Use Restriction, new NFA request, as well as all ADEQ VRP review and oversight costs. The remediation was completed on schedule and within budget and the closure report was recently submitted to ADEQ.

**General Electric Plastics, State WQARF Site, Chandler, Arizona** - Project manager of a PCE groundwater remediation site using pump and treat technology. Elements of the project included engineering and cost review of remedial activities, interpretation of remediation effectiveness, and interaction and representation with regulatory agencies. A study of rebound effects of PCE at area wells was also conducted following shut down of the groundwater remediation system.

**City of Phoenix, Former Fire Fighter Training Pit** - Project manager for soil and groundwater VOC remediation project. Remedial technologies included soil vapor extraction followed by bioventing. Evaluated soil, vapor and groundwater analytical data. Develop mass removal rates and totals, performed statistical analyses and compiled site closure report which was submitted to ADEQ through the VRP program. Formal closure has been received.

**DONALD P. HANSON, R.G.**

**Terminal Stations Truck Stop LUST Remediation, Tucson, Arizona** – Project manager for the characterization, development of a corrective action plan (CAP), and remediation of a several-thousand-gallon gasoline release to subsurface soil and groundwater. The site was located near the intersection of Wilmot and I-10 in southeast Tucson. Characterization included defining the lateral and vertical (250+ feet) extents of BTEX and MTBE contamination in soil as well as the lateral impacts to groundwater. A detailed cost analysis was completed for the design, permitting, installation, and operation and maintenance of a SVE and catalytic vapor treatment system. The CAP was approved by ADEQ and the system was constructed and operated for several years after which clean closure of the LUST site was obtained.

**19th Avenue Landfill, Federal Superfund Site, Phoenix, Arizona** - Field supervisor and task manager for well rehabilitation program, including pump removal and installation, TV scan, and mechanical treatment. Developed costs estimates for pump equipment repair and/or replacement. Oversaw groundwater sampling for VOCs, SVOCs, inorganics, heavy metals, pesticides, radionuclides, and bacteria. Managed monitoring well installation and aquifer testing.

**27th Avenue Landfill and Del Rio Landfill (16th Street), State WQARF Sites, Phoenix, Arizona** - Field supervisor and task manager for well rehabilitation program, including pump removal and installation, TV scan, and mechanical treatment. Developed costs estimates for pump equipment repair and/or replacement. Oversaw groundwater sampling for VOCs, SVOCs, inorganics, heavy metals, pesticides, radionuclides, and bacteria. Also analyzed methane and VOC vapor data from landfill gas probes and monitor wells.

**Motorola, Inc. (56th Street) Voluntary WQARF Site, Phoenix, Arizona** - Field supervisor and task manager for TCE soil investigation and well installation program. Obtained permits for well installation and off-site drilling access in city right-of-ways. Performed borehole logging, soil sampling, well installation and routine groundwater sampling.

**Training**

OSHA and EPA forty-hour safety training course and annual 8-hour refresher updates  
MSHA 24-hour safety training course and annual 8-hour refresher updates  
NWWA Groundwater and Unsaturated Zone Monitoring and Sampling - Short Course, Quality Assurance Seminar - ADHS, State Laboratory  
Design and Construction of Recovery and Injection Wells for Contaminant Recovery, Johnson Screen  
Dense, Nonaqueous Phase Liquid Contaminants (DNAPLs) in Porous and Fractured Media, Waterloo Centre for Groundwater Research  
Aquifer Restoration: Pump-and-Treat and the Alternatives, AGWSE  
RCRA-Avoiding the Most Common Mistakes in Waste Identification, Advanced Topics and Problem Solving, and Land Disposal Restrictions, McCoy and Associates, Inc.  
American Red Cross Multimedia Standard First Aid and Cardiopulmonary Resuscitation

**Professional  
History**

Manager, Phoenix Office, Harding Lawson Associates, Phoenix, Arizona  
Geologist, Dames & Moore, Phoenix, Arizona  
Water Production Assistant, City of Flagstaff

**Professional  
Affiliations**

Arizona Hydrological Society (AHS) - Phoenix Chapter  
Association of Ground Water Scientists and Engineers (AGWSE)  
National Groundwater Association  
American Institute of Professional Geologists

## **DONALD P. HANSON, R.G.**

### **Title**

Principal Hydrogeologist

### **Expertise**

Hydrogeology, Public Supply Wells, Groundwater Recharge, Water Resources

### **Academics**

B.S., Geology/Hydrogeology, Northern Arizona University, 1984

### **Registrations**

Registered Geologist, 1992 - Arizona Registration No. 26036

Professional Geologist, 1998 - Wyoming Registration No. PG-2983

### **Professional Experience**

Don Hanson joined Clear Creek Associates in May 2000. He has nearly 30 years of experience in developing water resource supplies, directing hydrogeologic investigations, and siting, design and construction management for public supply and aquifer storage and recovery (ASR) wells. Mr. Hanson is also extensively involved in the evaluation and rehabilitation of existing wells, and has presented numerous case studies on evaluating and improving well efficiency and water quality through well modifications.

Mr. Hanson has a wide range of technical capabilities in field investigations. He has supervised numerous drilling operations using virtually every drilling method, including air-rotary and mud-rotary rigs, reverse circulation, cable tool, hollow-stem auger, solid-stem auger, air hammer, and wireline coring. He has evaluated geophysical logs, zonal groundwater quality samples, rising/falling head tests and spinner logs. He has designed and managed the installation of ASR wells, numerous large-scale (>2,000 gpm) public supply wells, injection wells, and pump-and-treat extraction wells and monitoring wells. This extensive field background coupled with many years of technical consulting allows him to effectively manage a variety of water resources evaluations, well installation projects, remedial actions for environmental impairment, and groundwater recharge projects.

### **PRIOR TO JOINING CLEAR CREEK ASSOCIATES**

Mr. Hanson was manager of the Phoenix office of Harding Lawson Associates, a national engineering and environmental consulting firm.

### **Representative projects include:**

- **Taylor Morrison Homes** – Managed the permitting, design, and construction management of 4 new public supply wells in an area of known production limitations and arsenic impacts. All 4 wells met water quality standards and production requirements.
- **Vistancia, LLC.** – Manager for the design, permitting and installation of 6 new public supply wells to be conveyed to the City of Peoria. All projects included geophysical logging and zonal sampling. Innovative well designs were developed to take advantage of shallow production zones while still eliminating cascading water.
- **Pulte Homes, Inc.** – Technical expert for water resources development at several Master Planned Communities in the Phoenix metro area. Project manager for the siting, design and construction of 10 large-scale public water supply wells in areas with naturally occurring arsenic and fluoride impacts.
- **City of Chandler** - Managed the design and installation of 6 ASR wells for the Ocotillo Recharge Project and 9 ASR wells at the Tumbleweed Recharge and Recovery site. Each site is capable of recharging an average of 10 MGD. Projects included well design, bidding services, Water Storage, USF and APP permitting, well installation and testing and O&M support.
- **City of Scottsdale** – Managed the design, drilling, construction, and testing of a new public supply / ASR well. This project also included the design and installation of two deep groundwater monitoring wells for the City.
- **City of Mesa** – Managed a ten (10) well rehabilitation evaluation program for arsenic mitigation. Project included well video surveys, well cleaning oversight, spinner logging and depth-specific sampling, data interpretation, and preparation of well rehab

**DONALD P. HANSON, R.G.**

specifications. Several wells have been successfully rehabilitated and now meet the new arsenic standard without treatment.

- **Town of Gilbert** – Managed three rehabilitation evaluation projects for arsenic mitigation. Spinner log and zonal sampling data suggested that two of the three wells were candidates for well rehabilitation. Both rehabilitation projects were successful in mitigating the need for arsenic treatment while maintaining production capacity.
- **City of Chandler** – Manager for a city-wide exploratory boring program to site and design future public supply wells. Project included mud rotary drilling of 9 x 1,200 foot slim holes, packer testing for water quality, falling head tests for production and geophysical logging.
- **City of Glendale** – Managed the hydrologic study and conceptual design of new recharge facilities for expansion of the West Area WRF. Completed detailed hydrologic review of study area, conducted recharge siting evaluation, developed recharge rates, and completed mounding models to assess impacts to the hydrologic system.
- **City of Goodyear** – Managed an initial feasibility study for deep well brine disposal. Reviewed geophysical data to determine depth to bedrock and to develop optional locations for further exploration.
- **City of Phoenix** – Managed the hydrologic study and groundwater modeling for the NE Phoenix Aquifer Recharge Siting and Life Cycle Cost Analysis Project. Project included development of a recharge wellfield, particle tracking simulations, and life cycle costing analyses for an aquifer with severely declining water levels.

**Memberships**

Arizona Water Association (AZ Water)  
Arizona Hydrological Society (AHS) - Phoenix Chapter  
National Groundwater Association (NGWA)  
American Institute of Professional Geologists (AIPG)

**Publications**

2003–*Groundwater Recharge And Its Impacts On Non-Point Source Nitrate Contamination*, 11<sup>th</sup> Biennial Symposium on Groundwater Recharge, June.

2004–*Water Solutions for Development*: An invited presentation for the DR Horton Continental Series, Phoenix, Arizona, March 24, 2004.

2004–*Chandler's Reclaimed Water Program Yields 30 MGD Water Supply*, Co-author, 19<sup>th</sup> Annual Water Reuse Symposium, September.

2004–*The Data Game, How Much, What Kinds, and Why*. 20<sup>th</sup> Annual Tri-State Seminar-on-the-River, September.

2005–*Well Cleaning Eliminates Costly Arsenic Treatment*. AWPCA 78 Annual Conference and Exposition, May.

2005–*Maintaining ASR Well Efficiency*. 12<sup>th</sup> Biennial Symposium on Groundwater Recharge, June.

2005–*Is It a Pump or Well Problem*. 21<sup>st</sup> Annual Tri-State Seminar-on-the-River, September

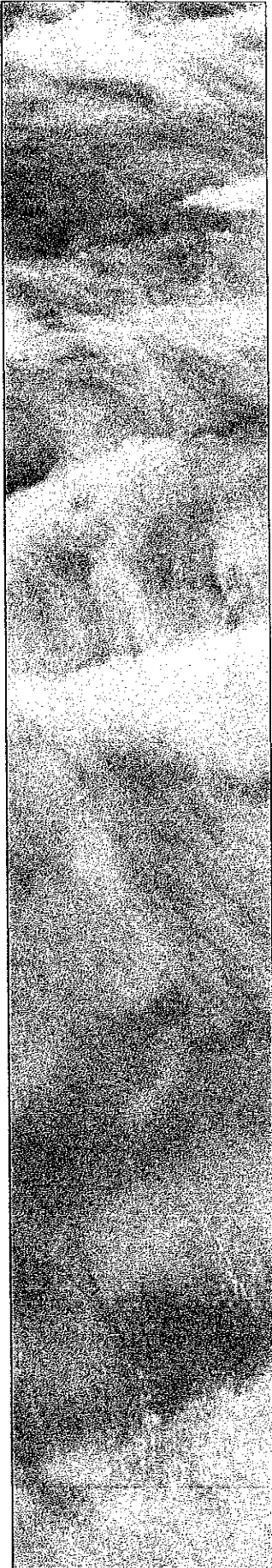
2006–*Developing a Wet Water Supply*. A presentation to Pulte Homes of Arizona, March.

2006–*New Well Techniques for Well Installation*. 22<sup>nd</sup> Annual Tri-State Seminar-on-the-River, September.

2008–*Groundwater Recharge and its Impacts on Non-Point Source Nitrate Contamination*. Peer reviewed article in The Professional Geologist, Volume 45, Number 4 August/September.

2010– *Groundwater Recharge – Tips for Siting, Design, and Operation*. 26<sup>th</sup> Annual Tri-State Seminar-on-the-River, September.

2011–*Well Evaluation Concepts and Techniques, Well Rehabilitation and Modification Methods*. ADEQ Operator Certification Program Workshop, February.



**DONALD P. HANSON, R.G.**

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- 2011-*Aquifer Recharge-From Vision to Reality*. 84<sup>th</sup> Annual AZ Water Conference, May.
- 2012-*Well Evaluation Concepts and Techniques, Well Rehabilitation and Modification Methods*. ADEQ Operator Certification Program Workshop, April.
- 2012- *Basin Recharge - Planning For Success*. 85<sup>th</sup> Annual AZ Water Conference, May.
- 2012- *117 Degrees in The Shade – Solutions to a Hot Water Supply Well*. 28<sup>th</sup> Annual Tri-State Seminar-on-the-River, September.
- 2012- *High Capacity Well Design*. National Groundwater Association, 2012 Groundwater Expo – Las Vegas, December.
- 2013- *Capitalizing on Well Capacity Analysis*. 86<sup>th</sup> Annual AZ Water Conference, May.
- 2013- *Well Screen Rehabilitation*. Groundwater Resources Association of California, High Resolution Tools and Techniques for Optimizing Groundwater Extraction for Water Supply Symposium, June.

## MARVIN F. GLOTFELTY, R.G

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### Title

Principal Hydrogeologist

### Expertise

Hydrogeology/Geology  
Water Resources Investigations  
Well Assessment, Design, Installation, and Rehabilitation

### Academic Background

M.S., Geology, Northern Arizona University, 1985  
B.S., Geology, Northern Arizona University, 1979

### Registration

Registered Geologist: Arizona No. 22744  
Registered Geologist: California No. 4988  
Licensed Well Driller: Arizona Nos. 160 and 672  
Licensed Contractor: Arizona No. 151387 (Type A-4)

### Experience

Areas of specialization include groundwater resources investigations, well siting studies, well design and construction management, evaluation and rehabilitation of water wells (including physical, chemical, and microbiological impacts), and water supply studies. Mr. Glotfelty is co-founder and Principal Hydrogeologist of Clear Creek Associates, and has been responsible for managing numerous hydrogeologic and water resources projects. During his career spanning over three decades, Mr. Glotfelty has been involved with almost every aspect of hydrogeology, water supply studies, aquifer testing, well design, well rehabilitation, water rights issues, and water quality assessment. He has been involved with the design, installation, rehabilitation, and abandonment of over 800 water wells in the United States. As detailed below, Mr. Glotfelty has given over 100 presentations on hydrogeologic and water well topics and he has authored over 20 publications, including a Dictionary of Driller's Terms (published by the National Ground Water Association in 2004), and editorial review of a chapter on Water Well Construction & Abandonment for the 3<sup>rd</sup> ed. *Groundwater & Wells*, which was published by Johnson Screens Co. (2007). In 1995, he received the *City of Phoenix Mayor's Environmental Award* for his work with rehabilitation of municipal wells to improve their water quality, and he was selected as the National Ground Water Association's *Distinguished McElhiney Lecturer* for 2012.

### WELL SITING STUDIES

Mr. Glotfelty has been involved with well siting studies and recharge siting studies covering approximately 1,500 square miles in Arizona, including projects for private water purveyors such as Arizona-American Water Company; Foothills Golf Club; Forest Highlands Golf Club; Global Water Company; Kachina Village Utilities; and Tonto Hills Water Company. He has also conducted well or recharge siting studies for municipalities in Arizona such as the Cities of Avondale, Casa Grande, Chandler, Mesa, Peoria, Phoenix, Scottsdale, Show Low, Surprise, and Tempe.

## **MARVIN F. GLOTFELTY, R.G**

### **PRODUCTION WELL DESIGN AND INSTALLATION**

Mr. Glotfelty has been involved with hundreds of projects involving the design and construction management of water supply well installations for municipalities, private water companies, mining facilities, power plants, or other industrial facilities.

#### **Public Supply Wells for Municipalities**

Includes *two wells* in Avondale, AZ; *one well* in Benson, AZ; *eleven (11) wells* in Buckeye, AZ; *six wells* in Chandler, AZ; *one well* in El Mirage, AZ; *two wells* in Goodyear, AZ; *two wells* in Kingman, AZ; *six wells* in Mesa, AZ; *three wells* in Nogales, AZ; *three wells* in Peoria, AZ; *eight wells* in Phoenix, AZ (of which two were Aquifer Storage & Recovery wells); *two wells* in Prescott, AZ; *seven wells* in Scottsdale, AZ (of which two were Aquifer Storage & Recovery wells); *one well* in Show Low, AZ; *thirteen (13) wells* in Surprise, AZ; *two wells* in Tempe, AZ; *two wells* in Tolleson, AZ; and *one well* in Yuma, AZ.

#### **Non-Municipal Water Well Installations**

Examples of *water supply well installations for private water companies* or other private entities include: Arizona-American Water Company (*nine wells* in the west Phoenix, AZ metropolitan area, and *two wells* at Bullhead City, AZ); Litchfield Park Service Company (*one well*); Metro Water Company in the north Tucson, AZ area (*three wells*); Global Water Resources in Buckeye, AZ (*six wells*); and Kachina Village Utilities near Flagstaff, AZ (*two wells*). *Industrial or irrigation well design/installation projects* include: First Solar Alpine Power Plant near Lancaster, CA (*one well*); California Baptist University at Riverside, CA (ongoing project, for *one well*); Foothills Golf Club in Phoenix, AZ (*two wells*); Harquahala Generating Power Plant in western AZ (*five wells*); and Forest Highlands Golf Association near Flagstaff, Arizona (*one well*). Mr. Glotfelty has also overseen the installation of *water supply wells on Native American lands*, such as: Window Rock High School at Fort Defiance, AZ; Second Mesa Day School at Second Mesa, AZ; and the Salt River Pima-Maricopa Indian Community near Mesa, AZ.

As Project Manager, Principal Hydrogeologist, or Principal-in-Charge for these projects, Mr. Glotfelty was responsible for the design, installation, and testing of the water supply well for the client. He coordinated contractor activities, and supervised preparation of lithologic logs, analyzed geophysical logs and sieve analyses of pilot hole cuttings, coordinated the collection and analysis of depth-specific groundwater samples, and supervised the collection and analysis of hydrologic data (falling-head tests). Based on that data, he supervised or prepared the site-specific well design for each public supply well. He also analyzed aquifer test data, and provided a recommended permanent pump setting and discharge rate for each new well.



## MARVIN F. GLOTFELTY, R.G

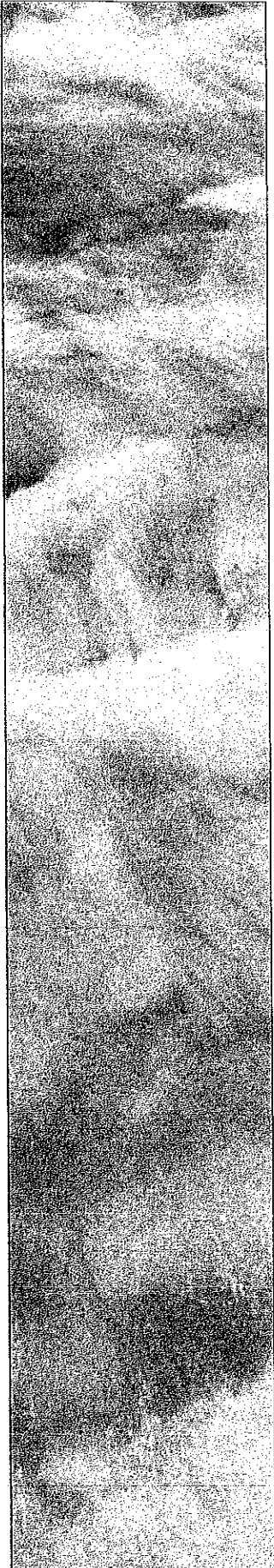
### WELL EVALUATION & REHABILITATION PROJECTS

Mr. Glotfelty conducted numerous well evaluation/rehabilitation projects for municipalities and private water companies to improve the pumped water quality through the structural modification of the well. These projects included site-specific well analyses utilizing flow profile analysis (spinner flowmeter logging or dye tracer profiling) under both dynamic (pumping) and static (non-pumping) conditions, along with and depth-specific groundwater sampling to determine the hydrogeologic, chemical, and biological conditions of the well. In addition, conventional aquifer test data were collected and analyzed for each well, and a well video survey of each well was conducted to assess its structural condition. Well evaluation/rehabilitation projects include: *four wells* for Arizona-American Water Company near Surprise, AZ; *four wells* for the City of Chandler, AZ; *twenty (20) wells* for the City of Cottonwood, AZ; *one well* for the Town of Gilbert, AZ; *five wells* for the City of Phoenix, AZ (**rehabilitation of Wells No. 211, No. 214, and No. 250 resulted in a 30% to 95% reduction of nitrate concentrations, for which Mr. Glotfelty was awarded the City of Phoenix Mayor's Environmental Award in 1995**); *eight wells* for the City of Mesa, AZ; *fourteen (14) wells* for Global Water Company in Pinal County, AZ; *one well* for the City of Scottsdale, AZ; *Two wells* for the City of Surprise, AZ; *five wells* for the City of Ontario, CA; *two wells* for San Antonio Water Company in Upland, CA; and *one well* for Adaman Water Company near Goodyear, AZ; and *one well* for the Harquahala Power Plant in western Arizona.

The tasks performed as part of these projects included: evaluation of the spinner logs or dye tracer flow profile data, as well as the depth-specific (zonal) groundwater samples under dynamic (pumping) as well as static (non-pumping) conditions; collection and analysis of aquifer test data; and review of well video surveys. When the well evaluation indicated structural modification would improve the well, the well rehabilitation design was based on these analyses. Mr. Glotfelty was responsible for the design and construction administration of the structural modification of each well. He coordinated and supervised the inner-string cementing operations, utilizing a combination of water well and oil well industry techniques.

### WATER RESOURCES INVESTIGATIONS

Water Resources Study, Salt River Valley, Citizens Utilities Company, AZ  
Project Manager and Principal Investigator. Coordinated a comprehensive water resources study that covered almost 2,000 square miles in the west Salt River Valley, and included evaluations of the current and future groundwater and surface-water resources through use of the computer model MODFLOW, as well as comprehensive geologic, hydrogeologic, and water quality assessments. Based on evaluations of potential water distribution systems, groundwater



## **MARVIN F. GLOTFELTY, R.G**

recharge options, population and land use projections, and regulatory constraints, the water resources investigation provided a prioritization of the development options available to the client.

### **Evaluation of Patterson and Fulton Wells, City of Peoria, AZ**

Project Manager. Evaluated two municipal wells to assess the problem of sand invasion in one well and the problem of aerated water in the other well. Specific tasks for this project included review of all documentation from the City's files pertaining to the wells, evaluation of the City's water distribution system model, and a cost-benefit analysis to determine the most cost-effective and feasible alternative for the remediation of the problem at each well. The investigation resulted in the identification and prioritization of several alternatives for addressing each well's problem. The top-ranked solution for each well was recommended, and a detailed discussion of the proper approach and protocol for the design and installation of a public supply well was also provided in the final report.

### **Central Arizona Project Water Use Feasibility Study, Citizens Utilities, West Salt River Valley, AZ**

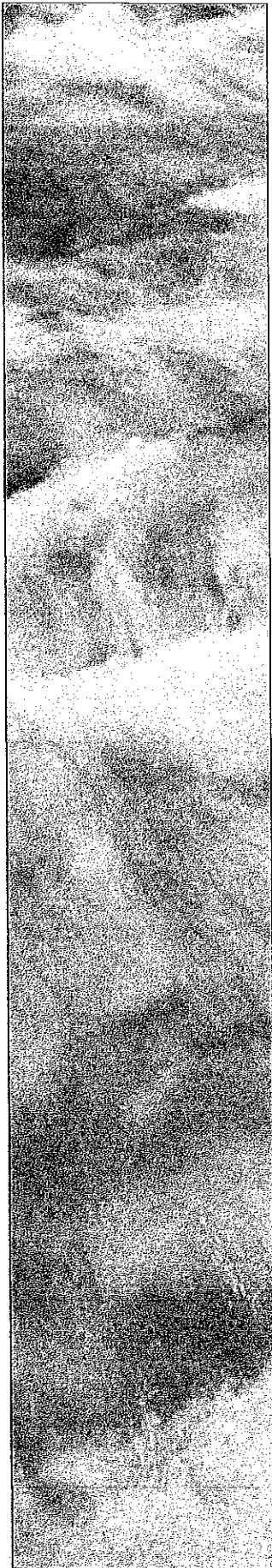
Project Manager and Project Hydrogeologist. Conducted a water use feasibility investigation in preparation for rate adjustment proceedings before the Arizona Corporation Commission (ACC). The investigation included the evaluation of four water use options related to direct treatment and use of CAP water or alternatives for groundwater recharge projects. The water use feasibility study included consideration of the hydrologic impact of each alternative, as well as the economic benefits or disadvantages of each option. The project was completed within a very tight schedule and in budget, and received a letter of commendation from the client.

### **City of Surprise Groundwater Recharge Feasibility Study, Surprise, AZ**

Project Manager. Hydrogeologic investigation involving the preparation of several hydrogeologic cross sections and determination of aquifer and vadose zone characteristics. The purpose of the recharge feasibility study was to determine appropriate recharge locations and methods for injection of Central Arizona Project water and treated effluent that will result in a long-term reliable water resource for the City of Surprise.

### **Basin-Wide Hydrologic Investigation, AZ**

Project Manager and Principal Investigator, confidential client. Collected and analyzed over 70 years of hydrologic data from the large (300-square-mile) basin. Development of the database for the project included the collection of groundwater elevation and quality data in order to define water rights and prepare for potential litigation relating to the ongoing adjudication of the Gila River System. Analyses included collection of hydrologic data in the field, as well as



## **MARVIN F. GLOTFELTY, R.G**

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review of over 60 publications, review of approximately 500 water level measurements, 650 drillers' logs, and 4,000 water quality analyses.

### **Hydrogeologic Investigation, Double-O Ranch, Seligman, AZ**

Project Manager and Principal Investigator. Hydrogeologic study of a large (365 square miles under fence) ranch. The project involved evaluation of the groundwater resources of the ranch, and the physical and economic options for development of a distribution (pipeline) system for delivering water to northern Arizona communities (such as Tusayan, Flagstaff, Williams, and the Navajo Nation). The aerial extent and geology at the ranch necessitated consideration of groundwater flow within fractured Paleozoic sandstone and limestone aquifers, fractured volcanic rock, and also basin-fill alluvial aquifers. The evaluation included the analysis of geologic lineaments on the ranch to determine the most favorable groundwater flow paths through the fracture-dominated aquifer systems. This project included the preparation of numerous geologic cross sections and groundwater elevation maps, as well as an evaluation of the physical and economic requirements to distribute the water to neighboring communities through an existing easement.

### **ASSURED/ADEQUATE WATER SUPPLY STUDIES**

Performed dozens of water adequacy studies and assured water supply studies throughout Arizona from 1984 to present. Projects required the demonstration of an adequate 100-year water supply to the satisfaction of the Arizona Department of Water Resources. Tasks included aquifer testing and analysis, preparation of groundwater elevation contour maps, preparation of hydrogeologic cross sections, water quality analysis, analysis of the volume of groundwater which underlies the property, water demand determination, and evaluation of surface water versus groundwater (as necessary for water rights demonstration). For larger or more complex land areas, groundwater modeling was required, which includes model calibration and verification, and simulation runs for a period of 100 years.

### **LITIGATION SUPPORT**

Water Well Evaluation and Expert Testimony, Arbarca et al v. Merck & Co., Inc., et al, Merced, California

Performed an evaluation of a public supply well alleged to have been a pathway of hexavalent chromium contamination, and provided expert testimony before the United States District Court (Case No. 1:07-CV-0388-OWW-DLB). The well evaluation included the review of well records, video survey analysis, spinner/temperature log analysis, and personal communication with the retired driller who installed the well. Based on this information, an expert report, rebuttal report, and other supplemental reports were prepared. Mr. Glotfelty

**MARVIN F. GLOTFELTY, R.G**

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provided deposition testimony, as well as direct and rebuttal testimony before both the judge and jury.

**Well Evaluation and Expert Testimony, Wrenn / Bender, LLLP, in support of Gallade Chemical Company, California Superior Court (Orange County) Irvine, California.**

Performed an in-depth assessment of several water supply wells, and reviewed regional hydrogeologic data and other expert reports relating to Orange County Water District v. Sabic Innovative Plastics US, LLC et al (Case No. 30-2008-00078246-CU-TT-CXC). This case involved a dispute regarding alleged impacts to a public supply well in the vicinity of the Gallade facility. The well evaluation included the review of well records, video surveys, and well log analysis. Based on that information, Mr. Glotfelty prepared an expert briefs and exhibits, and provided deposition testimony.

**Well Evaluation and Expert Testimony, Hassard Bonnington, LLP, in support of Hanson Aggregates Mid-Pacific, Inc. in California Superior Court (Santa Barbara County) Santa Barbara, California.**

Performed an in-depth assessment of a water supply well, reviewed regional hydrogeologic data, and records from the driller, hydrogeologist, and cement supplier involved with the well installation. Other expert reports relating to the case were also reviewed. Slippery Rock Ranch, LLC v. Hansen Well-Do Service, Inc. (Case No. 1381827). This case involved a dispute regarding alleged responsibility for problems with the installation of cement seals in the well, during its construction. The well assessment included review of well records, video surveys, field notes. Based on that information, Mr. Glotfelty prepared expert reports and exhibits, and also provided deposition testimony along with direct and rebuttal testimony before a judge and jury.

**Hydrologic Investigation and Expert Testimony, NextLight Renewable Power, Arizona Corporation Commission Hearing, Phoenix, Arizona**

Performed an in-depth groundwater resources evaluation of the Whitewing Ranch area, near Dateland, Arizona in support of a hearing presented by NextLight Renewable Power before the Line Siting Committee and the Arizona Corporation Commission (ACC). The hearing involved approval of a planned utility-scale solar power plant, which would require approximately 3,000 acre feet of water per year. The hydrogeologic study included aquifer testing and development of a groundwater flow model to simulate future impacts on both availability and quality of groundwater in the future. Mr. Glotfelty provided oversight of the preparation of a technical report, which was submitted to the ACC hearing officer as direct evidence, and he provided direct and rebuttal testimony before both the Line Siting Committee and ACC hearing officer.

## **MARVIN F. GLOTFELTY, R.G**

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**Hydrogeologic Investigation and Expert Testimony, Ryley Carlock & Applewhite, Abbott versus Brady, Casa Grande, Arizona**

Performed a hydrogeologic evaluation and provided expert testimony before the United States District Court. This case involved a dispute relating to alleged damages resulting from dewatering activities associated with the construction of a basement facility.

**Hydrogeologic Investigation and Expert Testimony, Noel Hebets, Esq., Trimble versus Chattman, Cave Creek, Arizona**

Performed a water resources evaluation and provided expert testimony before Arizona Superior Court and in a Hearing of the Gila River Adjudication. This case involved a dispute relating to surface water/groundwater rights relating to a small spring emitting from a mine adit in central Arizona.

**Hydrologic Investigation and Expert Testimony, Citizens Utilities Company Rate Case, Phoenix, Arizona**

Performed a comprehensive water resources evaluation of the West Salt River Valley (based on the previous work of Mr. Glotfelty and others), in support of a Rate Case presented by Citizens Utilities before the Arizona Corporation Commission. The rate case involved the planned annual use and usefulness of over 17,000 acre feet of water from the Central Arizona Project (CAP) aqueduct. This was one of the largest rate cases for a private water company in the history of the state. Specific tasks included submittal of two reports as direct evidence, written rebuttal testimony, written surrebuttal testimony, written rejoinder testimony, and oral expert testimony and response to cross-examination.

**Hydrogeologic Evaluation and Review of Reports for the Verde Valley Water Users Association, Cottonwood, Arizona**

Project Manager and Principal Hydrogeologist. Reviewed hydrogeologic reports relating to the adjudication of the Gila River System. Complex issues relating to the relationship between surface water and groundwater were evaluated and discussed. The proposed methods to differentiate groundwater and surface water in expert testimony by others was reviewed and assessed.

**Hydrologic Evaluation Relating to the Rehabilitation of a Public Supply Well, City of Peoria, Arizona**

Project Manager and Principal Hydrogeologist. Performed a hydrologic evaluation and provided technical support relating to a dispute involving potential litigation. A public supply well had been purchased from Sunny Boy Water Company by the City, and had been rehabilitated to improve its water quality. Contractual obligation for payment for the well rehabilitation by the water company was contested. Project issues included groundwater quality, well design and hydraulics, and the local/regional hydrogeologic system. Technical opinion was provided which resulted in a resolution in favor of the City.

**MARVIN F. GLOTFELTY, R.G**

Hydrogeologic Report, Grossman, O'Grady & McGoldrick, Arizona  
Testified in an arbitration hearing for the case of U.S. West Communications, Inc. versus Adolf DeRoy Mark. Project issues included well design and hydraulics, and the nature of the local hydrogeologic system in the Cave Creek area.

**ENVIRONMENTAL HYDROGEOLOGY**

Large-Scale Aquifer Protection Permit Application Program, Mining Company-Confidential Client, Arizona

Principal Hydrogeologist. Prepared five monitor well designs, and coordinated field activities for the installation of the monitor wells. This project required extensive hydrogeologic and hydrochemical analyses to address the complex geology at the site, and meet the requirements of the Arizona Department of Environmental Quality.

Aquifer Protection Permit Application Program, Stone Container Corporation, Snowflake, Arizona

Senior Hydrogeologist. Prepared three monitor well designs, and supervised field activities for installation of the monitor wells and a continuous core boring. The well designs utilized state-of-the-art technologies and innovative approaches in order to allow for acceptable data acquisition and resist corrosion in the very saline hydrogeological environment. This project required extensive hydrogeologic and hydrochemical analyses, which have been accepted by the Arizona Department of Environmental Quality. Site Characterization Study, RCRA Hazardous Waste Management Facility Designed wells, supervised drilling program, and conducted geophysical log interpretation for the installation of 29 monitor wells, observation wells, and exploratory borings. The project included continuous coring of over 1,200 feet of alluvium with a wireline core rig, and collection of over 550 feet of driven samples with a hollow-stem auger. Also utilized mud-rotary and air-rotary drilling techniques.

**Professional  
Memberships  
and  
Associations**

Northern Arizona University College of Engineering and Natural Sciences Advisory Council.

Northern Arizona University Geology Department Advisory Council.

Arizona Hydrological Society (AHS Board of Directors, 1989 to 1993; AHS Phoenix Chapter Vice President, 1990, 1991; AHS Foundation President-elect, 2010-11).

Arizona Water Well Association (Technical Director, 1990 to present; Legislative Committee, 1993 to present).

Mountain States Groundwater Expo (a symposium and conference of the Water Well Association of five southwestern states) (Symposium Coordinator, 1991, 1994, and 1995).

National Groundwater Association (since 1984).

Honorary Advisory Board of Groundwater Age Magazine (1993 to 1995).

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations**

**Glottfelty, M.F.**, 2013 *Life Cycle Economic Analysis of Water Wells – Valid for Smaller Wells Too: “Making Connections”* – The official publication of the Louisiana Ground Water Association, Premier Issue, Summer 2013.

**Glottfelty, M.F.**, 2013 *Life Cycle Economic Analysis of Water Wells – Considerations for Design and Construction*: Presentation as part of the Design and Construction of Economic Wells Workshop at the International Mine Water Association Conference, Golden, Colorado, August 5, 2013.

**Glottfelty, M.F.** and Becker, A., 2013, *Drilling Fundamentals for Hydrogeologists and Engineers Workshop*: a one-day workshop at the National Ground Water Association Summit, San Antonio, Texas, April 28, 2013.

**Glottfelty, M.F.**, 2012 *Life Cycle Economic Analysis of Water Wells – Considerations for Design and Construction*: Distinguished Lecturer for the National Ground Water Association, 2012. Included 37 lectures to well driller associations; hydrological societies; university students and faculty; engineering groups; and water managers in 17 US states and Canada, in addition to translated webinar presentations in Bolivia and Columbia.

**Glottfelty, M.F.**, 2012, *Guest Lecturer – Applied Hydrogeology, Geology 451, Northern Arizona University*: Guest lecturer, NAU Geology Dept., Flagstaff, Arizona, November 9, 2012.

**Glottfelty, M.F.** and Becker, A., 2012, *Drilling Fundamentals for Hydrogeologists and Engineers Workshop*: a one-day workshop at the National Ground Water Association Summit, Garden Grove, California, May 6, 2012.

**Glottfelty, M.F.**, 2011, *Guest Lecturer – Applied Hydrogeology, Geology 451, Northern Arizona University*: Guest lecturer, NAU Geology Dept., Flagstaff, Arizona, November 8, 2011.

**Glottfelty, M.F.** and Kill, D.L., 2011, *Environmental and High-Capacity Water Well Design Workshop*: a two-day workshop sponsored by the National Centre for Groundwater Education and Training, and the National Ground Water Association, Brisbane, Australia, October 10-11, 2011.

**Glottfelty, M.F.** and Kill, D.L., 2011, *Environmental and High-Capacity Water Well Design Workshop*: a two-day workshop sponsored by the National Centre for Groundwater Education and Training, and the National Ground Water Association, Perth, Australia, October 6-7, 2011.

**Glottfelty, M.F.** and Heller, N., 2011, *Well Evaluation and Reconstruction Techniques Workshop*: Full-day workshop for the AZ Dept. of Environmental Quality, Tucson, Arizona, April 26, 2011.

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations  
(continued)**

**Glottfelty, M.F.**, 2011, *What Do We Know For Sure? Considerations of "Unknown Unknowns" in the Water Well Industry*: Presentation at the Mountain States Groundwater Expo – 2011, Laughlin, Nevada, February 10, 2011.

**Glottfelty, M.F.**, 2010, *Guest Lecturer – Applied Hydrogeology, Geology 451, Northern Arizona University*: Guest lecturer, NAU Geology Dept., Flagstaff, Arizona, November 2010.

**Glottfelty, M.F.**, and Best, M.E., 2010, *Design Versus Constructability - Considerations for Water Supply Wells*: Workshop at the 26<sup>th</sup> Annual Tri-State Seminar-On-The-River Conference, Primm, Nevada, September 30, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Reconstruction Techniques: Cost Effective Methods and Considerations*: Half-day workshop presented at the Annual Symposium of the Arizona Hydrological Society, Tucson, Arizona, September 1, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Reconstruction Techniques: Cost Effective Methods and Considerations*: Invited presentation to the City of Pomona, California, August 18, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Reconstruction Techniques: Cost Effective Methods and Considerations*: Invited presentation to the Salt River Project, Phoenix, Arizona, August 3, 2010.

**Glottfelty, M.F.** and Heller, N., 2010, *Groundwater Production Well Performance Diagnostics, Data Evaluation, and Reconstruction Methods*: Invited presentation at a full-day workshop for the AZ Dept. of Environmental Quality, Flagstaff, Arizona, June 15, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Reconstruction Techniques: Cost Effective Methods to Improve Water Quality*: Invited presentation to the Inland Counties Water Association, Ontario, California, June 9, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Reconstruction Techniques: Cost Effective Methods and Considerations for Water Purveyors*: Invited presentation to the City of Casa Grande, Arizona, May 25, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Rehabilitation, Cost-Effective Methods and Considerations for Water Purveyors*: Invited presentation to the Phoenix Chapter of the Arizona Hydrological Society, April 13, 2010.

**MARVIN F. GLOTFELTY, R.G**

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**Publications/  
Presentations  
(continued)**

**Glottfelty, M.F.**, 2010, *Well Evaluation and Rehabilitation, Cost-Effective Methods and Considerations for Water Purveyors*: Invited presentation for the Town of Gilbert, Arizona, April 7, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Rehabilitation, Cost-Effective Methods and Considerations for Water Purveyors*: Invited presentation for the Town of Buckeye, Arizona, March 24, 2010.

**Glottfelty, M.F.**, 2010, *Well Evaluation and Rehabilitation, Cost-Effective Methods and Considerations for Water Purveyors*: Invited presentation for the City of Surprise, Arizona, March 16, 2010.

**Glottfelty, M.F.**, 2009, *Water Well Design and Site Selection*: Invited presentation at the Lorman Seminar: Groundwater Wells, Rights and Uses in Arizona. Phoenix, Arizona, February 3, 2010.

**Glottfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of San Fernando, California, October 8, 2009.

**Glottfelty, M.F.**, 2009, *Guest Lecturer – Applied Hydrogeology, Geology 451, Northern Arizona University*: Guest lecturer, NAU Geology Dept., Flagstaff, Arizona, November 2009.

**Glottfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, Golden Hills Community Services District, Tehachapi, California, October 7, 2009.

**Glottfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, Los Angeles Department of Water and Power, Los Angeles, California, October 6, 2009.

**Glottfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Paramount, California, September 9, 2009.

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations  
(continued)**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Southern California Water Utilities Association workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, Glendora, California, July 8, 2009.**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, Coachella Valley Water District, Coachella, California, June 2, 2009.**

**Glottfelty, M.F., 2009, *Water Well Rehabilitation – Economic Advantages and Technical Considerations*. Invited presentation at a Lorman Educational Services Teleconference. Phoenix, Arizona, May 28, 2009.**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Redlands, California, May 27, 2009.**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Big Bear Lake, California, May 21, 2009.**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Alhambra, California, May 20, 2009.**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction City of Glendale, California, May 19, 2009.**

**Glottfelty, M.F. and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, Victorville Water District, Victorville, California, May 18, 2009.**

**Glottfelty, M.F., Heller, N., and Bates, G., 2009, *Production Well Profiling Analysis*. Invited presentation at the Workshop on Groundwater Production**

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations  
(continued)**

Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of San Bernardino, California, April 17, 2009.

**Glotfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Orange, California, April 9, 2009.

**Glotfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Hesperia, California, April 8, 2009.

**Glotfelty, M.F.**, 2009, *El Desarrollo y Aplicacion de Evaluaciones Geohidrológicos* [Designing and Implementing Hydrogeological Assessments]. Invited presentation for the Arizona-Baja California Sur Partnership for Water Sustainability, La Paz, Mexico, March 27, 2009.

**Glotfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction, City of Palm Springs, California, March 25, 2009.

**Glotfelty, M.F.** and Heller, N., 2009, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction for the City of Newport Beach, California, March 24, 2009.

**Glotfelty, M.F.**, 2009, *Physical Considerations for Well Design and Construction*: Invited Presentation at the Mountain States Groundwater Expo – 2007, Laughlin, Nevada, February 12, 2009.

**Glotfelty, M.F.**, 2009, *Water Well Design and Site Selection*: Invited presentation at the Lorman Seminar: Groundwater Wells, Rights and Uses in Arizona. Phoenix, Arizona, February 3, 2009.

**Glotfelty, M.F.** and Heller, N., 2008, *Production Well Profiling Analysis and Production Well Reconstruction Methods*. Invited presentation at the Workshop on Groundwater Production Well Performance Diagnostics, Data Evaluation, and Engineered Reconstruction for the Irvine Ranch Water District, Irvine, California, October 23, 2008.

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations  
(continued)**

**Glotfelty, M.F.** and Wrzosek, D., 2008, *Water Well Design and Construction Management*: Workshop presented for the City of Mesa, Mesa, Arizona, April 11, 2008.

**Glotfelty, M.F.** and Morris, T., 2008, *Installation, Operation, Rehabilitation, and Evaluation of Water Wells – A Comprehensive Workshop for Well System Operators*: Two-Day Workshop presented for the City of Chandler Reverse Osmosis Facility Annual Training, Chandler, Arizona, March 18 & 19, 2008.

**Glotfelty, M.F.**, 2008, *Water Well Design and Site Selection*: Invited presentation at the Lorman Seminar, Groundwater Wells: Use and Shared Use Agreements in Arizona. Phoenix, Arizona, February 28, 2008.

**Glotfelty, M.F.** and Gin, G., 2008, *Life-Cycle Cost Analysis of Water Well Materials*: Presentation at the American Groundwater Trust Water Well Performance Workshop, Economic Basis for Operation, Well Rehabilitation & Maintenance Decisions – February 7, 2008, Phoenix, Arizona.

**Glotfelty, Marvin F.**, 2007, *Groundwater & Wells*: 3<sup>rd</sup> Ed., Sterrett, R.J., ed., Johnson Screens, a Weatherford Company, 2007. Technical Reviewer of Chapter 10 - Water Well Construction and Abandonment pp. 439 – 500. Authored Appendix 9-Q – Public Supply Well Installation Flow Chart (in attached CD).

**Glotfelty, M.F.**, 2007, *Guest Lecturer – Applied Hydrogeology, Geology 451, Northern Arizona University*: Guest lecturer, NAU Geology Dept., Flagstaff, Arizona, November 2007.

**Glotfelty, M.F.**, 2007, *Water Well Design, Evaluation, and Site Selection*: An invited presentation for Centex Homes, Scottsdale, Arizona, November 5, 2007.

**Glotfelty, M.F.**, Gin, G., and Tatlow, M., 2007, *Design and Construction Techniques for Recharge and Recovery Wells*: Full-day workshop at ISMAR6 - the International Symposium on Managed Aquifer Recharge – October 28 – November 2, 2007, Tempe, Arizona. October 28, 2007.

**Glotfelty, M.F.**, and Burchard, G.C., 2007, *Well Assessment Technologies, a.k.a. Well Video Interpretation*: Presented as a workshop at the 23<sup>rd</sup> Annual Tri-State Seminar-On-The-River Conference sponsored by the Arizona Water Pollution Control Association, Primm, Nevada, September 28, 2007.

**Glotfelty, M.F.**, 2007, *Water Well Design and Site Selection*: Invited presentation at the Lorman Seminar, Groundwater Wells in Arizona: Quantity, Quality, Shared Use, Value, and Restrictions. Phoenix, Arizona, February 28, 2007.

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations  
(continued)**

**Glotfelty, M.F.**, 2007, *Material Selection For Proper Well Design*: Invited Presentation at the Mountain States Groundwater Expo – 2007, Laughlin, Nevada, February 8, 2007.

**Glotfelty, M.F.**, and Bartlett, R.D., 2007, *Environmental Issues Affecting Groundwater Resources*: Invited presenters for a Lorman National Teleconference, January 25, 2007.

**Glotfelty, M.F.** and Burchard, G.C., 2006, *Well Video Interpretation*: National Ground Water Association 2006 Ground Water Expo, Las Vegas, Nevada, December 5-8, 2006.

**Glotfelty, M.F.**, 2006, *Water Well Design and Site Selection*: Invited presentation at the Lorman Seminar, Groundwater Wells: Quantity, Quality, Shared Use, Value, and Restrictions. Phoenix, Arizona, October 4, 2006.

**Glotfelty, M.F.**, 2006, *Water Well Design and Installation*: An invited presentation for Montalbano Homes, Scottsdale, Arizona, April 7, 2006.

**Glotfelty, M.F.**, 2006, *String Weight Changes during Well Installation*: Well Said – the Newsletter of the Arizona Water Well Association, March 10, 2006.

**Glotfelty, M.F.**, 2006, *Water Well Design and Site Selection – Techniques to Economically Address Water Quality and Quantity Challenges*: Invited presentation at the Lorman Seminar, Groundwater Wells: Quantity, Quality, Shared Use, Value, and Restrictions. Phoenix, Arizona, February 28, 2006.

**Glotfelty, M.F.**, 2005, *Water Well Design and Site Selection*: Invited Presentation for the Arizona Department of Environmental Quality Safe Drinking Water Section, November 15, 2005.

**Glotfelty, M.F.**, 2005, *Water Well Assessment Techniques, Part I and II*: Presented as a workshop at the 21<sup>th</sup> Annual Tri-State Seminar-On-The-River Conference sponsored by the Arizona Water Pollution Control Association, Laughlin, Nevada, September 23, 2005.

**Glotfelty, M.F.**, Alter, M., Destrampe, R., and Bredfeldt, P., 2005, *New Water Supply Well Installation – From design to Acceptance*: Full-day workshop presented at the 2005 Annual Symposium of the Arizona Hydrological Society, Phoenix, Arizona, September 21, 2005.

**Glotfelty, M.F.**, 2005, *Hydrogeological and Water Resource Management Considerations for ASR in the West Salt River Valley*: Presented at the 12<sup>th</sup>

**MARVIN F. GLOTFELTY, R.G**

**Publications/  
Presentations  
(continued)**

Biennial Symposium on Groundwater Recharge, Phoenix, Arizona, June 10, 2005.

**Glottfelty, M.F.**, 2005, *An Overview of Water Supply Well Design, Installation, Operation, and Rehabilitation*: Invited Presentation at the Water and Wastewater Workshop, Arizona Department of Environmental Quality, Safe Drinking Water section, March 24, 2005.

**Glottfelty, M.F.**, 2005, *An Overview of Water Supply Well Design, Installation, Operation, and Rehabilitation*: Invited Presentation at the Water and Wastewater Workshop, Arizona Department of Environmental Quality Safe Drinking Water Section, February 3, 2005.

**Glottfelty, M.F.**, 2005, *Hydrogeological Issues in the West Salt River Valley with Aquifer Storage and Recovery Sites*: Invited Presentation at the Arizona Water Pollution Control Association Seminar: Reclaiming a Lost Resource - Challenges of Poor Quality Groundwater, Phoenix, Arizona, February 3, 2005.

Boyd, B., and **Glottfelty, M.F.**, 2004, *A Unique Technique for Rehabilitating a Poorly Producing Well*: Presentation to the Phoenix Chapter of the Arizona Hydrological Society, Phoenix, Arizona, November 9, 2004.

**Glottfelty, M.F.**, 2004, *General Concepts in Well Construction and Management*: Presented as a workshop at the 20<sup>th</sup> Annual Tri-State Seminar-On-The-River Conference sponsored by the Arizona Water Pollution Control Association, Laughlin, Nevada, September 24, 2004.

**Glottfelty, M.F.**, 2004, *Consultant/Contractor Communication – Challenges and Solutions During Well Construction and Maintenance*: Presented as a workshop at the 20<sup>th</sup> Annual Tri-State Seminar-On-The-River Conference sponsored by the Arizona Water Pollution Control Association, Laughlin, Nevada, September 24, 2004.

**Glottfelty, M.F.**, and Hanson, D.P., 2004, *Water Solutions for Development*: An invited presentation for the DR Horton Continental Series, Phoenix, Arizona, March 24, 2004.

**Glottfelty, M.F.**, Gordon, S.L., and Peterson, R., (senior editors), 2004, *Illustrated Glossary of Driller's Terms*: National Ground Water Association press, 34 p.

National Ground Water Association, 2003, *Illustrated Glossary of Ground Water Industry Terms: Hydrogeology, Geophysics, Borehole Construction, and Water Conditioning*: Compiled by (in alphabetical order), Linda Aller, Ed Anderson, Dana Armitage, Truman Bennett, Jack DeMarre, Jane Dunne, Tyler

## **MARVIN F. GLOTFELTY, R.G**

### **Publications/ Presentations (continued)**

E. Gass, **Marvin F. Glotfelty**, Sheryl L. Gordon, Glen Hackett, Harold Heiss, W. Scott Keys, Jay H. Lehr, Kevin McCray, David Nielsen, Ron Peterson, Rebecca Petty, Wayne Pettyjohn, Jim Poehlman, Joseph Ritchie, Helen Sedoris, and Stuart Smith. Editorial review and photographs by Clear Creek Associates, 69 p.

**Glotfelty, M.F.**, 2003, *Considerations and Pitfalls of Well Design, Installation, and Rehabilitation*: Invited Presentation at the Water and Wastewater Workshop sponsored by the Arizona Department of Environmental Quality Safe Drinking Water Section, Phoenix, Arizona, November 13, 2003.

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## *Practical Solutions In Groundwater Science*

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### **Introduction**

Clear Creek Associates provides professional consulting services in groundwater resource projects and environmental investigations, with an expertise in hydrogeologic studies, water well design and reconstruction, aquifer storage and recovery, groundwater modeling, environmental investigations, and mining support.

Our company was founded in 1999 as a small group of geologists and hydrologists committed to providing practical solutions in groundwater science and excellent client service. Based on this principle, our company has grown and expanded to include a staff of about 40 in our offices located in Arizona (Scottsdale and Tucson), California (Claremont), and Virginia (Leesburg).

Water-related problems vary from place to place, but the universal challenges faced across the nation and around the world include water quality, water availability, and cost. At Clear Creek Associates, we believe the keys to solving any water-related problem are a complete understanding of the underlying science that affects the water issue, and wide-ranging experience to offer practical and achievable solutions. Clear Creek was founded by veteran hydrogeologists and we have grown into a collaborative team of highly-qualified geologists, hydrologists, environmental engineers, and project professionals with unsurpassed capabilities and professional experience. Together, we provide our clients with the knowledge and insight gained by over 550 years of cumulative experience in honing our core science, our technical skills, and our ability to communicate honestly and clearly.

We founded our company with veteran hydrogeologists and built a strong team of trained scientists. Our staff now consists of highly qualified geologists, hydrologists, environmental engineers, and project professionals. The cohesiveness of our technical professionals and support staff is in large part responsible for our success.

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#### **The professionals at Clear Creek Associates provide true added value to our clients:**

About 60% of us have at least 15 years of professional experience.

About 20% of us maintain professional registration (PG, PE) in multiple states.

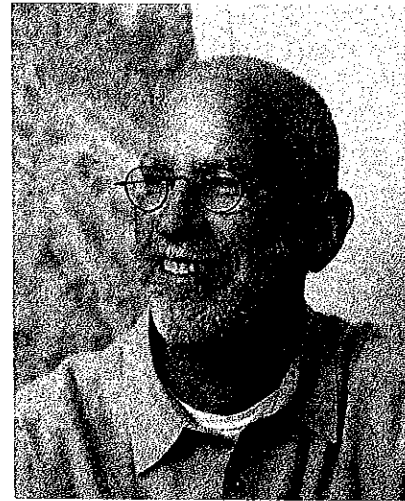
Over 30% of our cohesive team has been with us more than 10 years, and almost 65% of us have been here at least 5 years.

Clear Creek professionals have over 550 years of combined experience.



## Principal Staff

**Marvin Glotfelty, RG** is Principal Hydrogeologist and co-founder of Clear Creek Associates. He is both a Registered Geologist in Arizona and California, and also a Licensed Water Well Driller in Arizona. He is recognized as one of the leading experts in water well design and construction technology in the United States. During his professional career of about three decades, Marvin has been involved with the design, installation, rehabilitation, or decommissioning of over 800 water wells, and he has served as Technical Director of the Arizona Water Well Association for over 20 years (since 1990). He has given over 100 lectures and workshops to professional driller organizations, hydrogeologists, water system operators, and university students in 17 different U.S. states and five other countries. He has authored about 20 publications including a Glossary of Driller's Terms (NGWA, 2004), and he provided editorial review of a chapter for the 3rd edition of Groundwater & Wells (Johnson Screens Co, 2007).



Mr. Glotfelty specializes in conducting studies of groundwater systems for public and private water purveyors and other entities having particular groundwater-related problems. He brings a complete understanding of the problem to be solved and a strong sense of the hydrogeological sciences that must be implemented to resolve it. He has a depth of knowledge in the design, assessment, and rehabilitation of water wells, and is proficient in relating that information to the local groundwater system(s) being considered. Mr. Glotfelty also provides expert witness support for legal matters that involve groundwater and wells. For his innovative work on rehabilitation of municipal wells to improve their water quality, Mr. Glotfelty was awarded the City of Phoenix Mayor's Environmental Award in 1995, and he gained national prominence by being selected as the 2012 McElhiney Distinguished Lecturer for the National Ground Water Association.

**Doug Bartlett, RG, CHG, CPG**, is Principal Hydrogeologist and co-founder of Clear Creek Associates, who is a Registered Geologist and/or Certified Hydrogeologist in six states. Over the past 35 years, he has built a solid reputation as a hydrogeologist with diverse experience. Mr. Bartlett directs much of the firm's work in the areas of groundwater computer modeling, hydrogeologic investigations, and mining-related hydrogeologic services. At Clear Creek, he has managed numerous large projects including water supply investigations for developments and mining operations, obtaining Assured Water Supply, Underground Storage Facility, and Aquifer Protection Permits, investigation of groundwater contamination involving organic solvents, metals, and other hazardous compounds, and the design of groundwater remediation systems. Mr. Bartlett also provides expert witness support for legal matters that involve hydrogeology.



Over the past 35 years, Mr. Bartlett has developed many groundwater computer models to evaluate groundwater resources, assess the future impact of groundwater pumping, design groundwater recharge projects, trace the migration of contaminant plumes, and develop remedies to clean up contaminated groundwater. Mr. Bartlett also has considerable experience conducting hydrogeologic studies at mining sites throughout the western U.S. His mining projects have focused on both water supply and solving environmental problems for mining companies. Clear Creek Associates continues this strong relationship with the

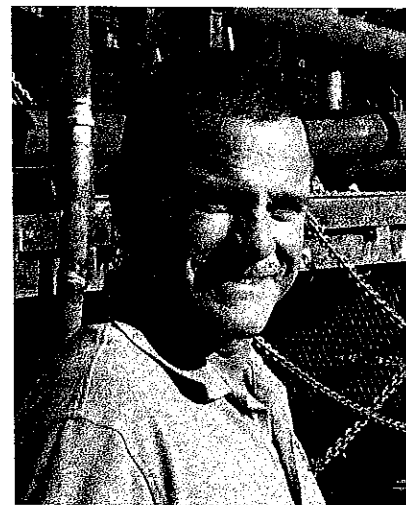


mining community in Arizona where Mr. Bartlett is currently overseeing numerous water resource and environmental projects at various Arizona mines.

**Tom Suriano, RG** is a Principal Hydrogeologist with more than 23 years of professional experience in managing environmental investigation and remediation projects at complex chlorinated solvent sites and hydrocarbon sites. Mr. Suriano is a Registered Geologist in Arizona, and is one of the state's leading experts in environmental site investigation and characterization, designing and implementing remedial actions, and in optimizing on-going remedial actions. Prior to joining Clear Creek Associates in 2006, Mr. Suriano was the Remediation Program Manager for Freescale Semiconductor, Inc. and its predecessor Motorola's Semiconductor Products Sector (SPS) and was responsible for managing environmental site assessment and remediation projects in the United States, Europe and Asia for over 13 years. Prior to working at Motorola, Mr. Suriano worked on environmental investigation and water resource projects at the Salt River Project in Phoenix, Arizona to develop water management plans for regional well networks and integrate water quality considerations into regional water resource planning. Mr. Suriano played an active role in developing Arizona's new Water Quality Assurance Revolving Fund (WQARF) legislation and in drafting the soil rule, the remedy selection rule, and the voluntary remediation program rule. Mr. Suriano was appointed by the Governor and served a term on the Water Quality Assurance Revolving Fund Oversight Board. Mr. Suriano currently works for a variety of municipal, mining and private sector clients at sites involved with CERCLA, RCRA, UST, VRP, and WQARF investigation and remediation activities, and he represents several municipal water providers at Superfund Sites, where he has responsibility for overall technical guidance, site investigation and remediation approach, and senior-level technical review of technical specifications and reports.



**Don Hanson, RG** is a Principal Hydrogeologist with over 28 years of environmental and water resources experience in Arizona. He is responsible for project management of both environmental and water resources projects, and serves as a technical resource for a variety of special projects. Prior to joining Clear Creek Associates, Mr. Hanson was the Phoenix Office Manager for the environmental and engineering consulting firm Harding Lawson Associates. During his 12+ year tenure at HLA, he managed numerous environmental projects ranging from the relatively simple ESA's and LUST sites to multi-million dollar, multi-year complex soil and groundwater projects. Mr. Hanson began his consulting career in 1984 with Dames & Moore, a large, internationally renowned engineering firm. With many years of experience working on both Federal and State Superfund projects involving various types of contaminants, Mr. Hanson has amassed a knowledge base that allows him to provide the technical expertise needed to develop cost effective site characterizations, feasibility studies, and remedial actions for complex groundwater contamination sites. He has authored numerous papers and given presentations on the methods and impacts of groundwater recharge.



**Michael Alter, M. Sc., PG, RG (VA, PA, AZ)** is the manager of Clear Creek's Northern Virginia office and has over 15 years of experience in geologic and hydrogeologic investigations for the mining industry, municipalities, and industrial facilities. Originally from Virginia, Mr. Alter attended Virginia Tech, where he received his Bachelor's degree in geology. He received his graduate degree from Arizona State University, where he worked under one of the premier structural geologists in the west. Mr. Alter's expertise is managing large-scale aquifer studies and remedial investigations in bedrock and sedimentary basin settings. Mr. Alter started Clear Creek Associates' Tucson Office in 1999, growing the office to a staff of 10 professional geologists. Prior to joining Clear Creek, he spent five years with Dames & Moore, an international environmental engineering firm. While with Dames & Moore, Mr. Alter specialized in water resources and water supply development projects at large-scale mining sites.



Mr. Alter recently returned to Virginia to start an east coast office for Clear Creek Associates. He is an expert in identifying and developing groundwater resources in fractured bedrock settings. He understands and knows when to apply investigative techniques such as geologic mapping, fracture-trace analyses, surface geophysics, exploration/test well drilling and aquifer testing. He has represented municipal and industrial clients on water resources investigations involving water well siting, design, installation, and testing; injection well design and operation; well rehabilitation; and long-term drawdown and mounding analyses. Mr. Alter has an exceptional technical expertise for these projects, but also has extensive experience with interacting with the public and negotiating with regulatory agencies. Mr. Alter's environmental investigation and remediation projects have included, among others, active and inactive landfills, petroleum fueling facilities, and mining sites. He is an expert on groundwater contamination issues associated with large-scale industrial operations, and has investigated and modeled complex contaminant plumes including chlorinated solvents, metals, and radionuclides. He has represented industrial, mining, and municipal clients in large-scale groundwater contamination projects under various federal, state, and local regulatory programs.



## Capabilities and Resources

### Groundwater Resources

Hydrogeologic studies for groundwater supply development

Water well design and preparation of technical specifications

Well drilling oversight and construction management

Bid support and driller selection

Well siting studies

- Fracture trace analyses
- Prioritization matrix development

Geophysical survey investigations

Water resources permitting

Aquifer testing and analysis

Water quality testing and analysis

Well assessment and rehabilitation

- Spinner log flow profile
- Dye tracer flow profile

- Depth-specific sampling

- Video survey inspection

Managed aquifer recharge projects

- Design and construction management of ASR wells; vadose zone wells; infiltration basins; infiltration trenches
- Recharge facility siting studies
- Efficiency assessment and optimization
- Storage volume assessments
- Mounding analyses
- Aquifer retention and transport studies
- Geochemical analysis of mixed water interactions
- Project monitoring and reporting



### Environmental Investigations

RI/FS and RCRA studies

Due Diligence Investigations

PRP investigations

Soil/groundwater remedy design, implementation, and optimization

Soil-gas monitoring

RCRA investigations/closure

Permitting (APP, NPDES, NEPA, Air)

Compliance and closure monitoring

Indoor air investigations

Phase I, II, and III ESAs

Third-party oversight



*continued*



### **Power Plant and Industrial Facility Support**

Planning, permitting and regulatory compliance  
Process and dust control water resource evaluations  
Hydrogeologic assessments and facility siting prioritization  
Geochemical analysis for scale control or aquifer recharge  
Geothermal studies

### **Mining Support**

Feasibility studies (environmental and water supply)  
Regulatory support and environmental permitting  
Mine/plant water management and discharge analyses  
CO<sub>2</sub> storage studies  
Brine disposal  
Injection well design and testing  
Underground and open pit water inflow analyses  
Geochemical characterization

### **Groundwater Modeling**

Impact studies for well field optimization  
Groundwater/surface water interactions  
Site characterization studies  
Well siting and wellfield management  
Wellhead protection and wellhead optimization modeling  
Water supply projections for land development or facility planning  
Dewatering studies  
Mounding analysis/unreasonable harm studies at groundwater recharge facilities  
Permitting and regulatory support for industrial facilities and mine sites  
Integrated modeling of groundwater–surface water interactions  
Flow and transport modeling at environmentally impacted sites  
Litigation support  
Remediation system design

### **Expert Witness Services and Litigation Support**

Experience with expert witness testimony includes:

- United States District Court (AZ and CA)
- Arizona Corporation Commission Hearings and Rate Cases (AZ)
- State Superior Court (AZ)
- Gila River Adjudication Hearings (AZ)
- Arbitration Hearings (AZ)

Litigation support and expert testimony on disputes related to:

- Environmental issues and contaminant plume migration
- Surface water/groundwater interaction
- Water rights issues
- Water well structure and integrity issues.

